WE CLAIM:

1. A polymer produced by a process comprising:

a) contacting one or more α-olefin monomers together in the presence of a catalyst under polymerization conditions,

wherein the catalyst was produced by:

i) contacting a soluble magnesium dialkoxide compound of the general formula $Mg(OR")_2$ with a halogenating agent capable of exchanging one halogen for one alkoxide to form a reaction product A, where R" is a hydrocarbyl or substituted hydrocarbyl having from 1 to 20 carbon atoms;

ii) contacting reaction product A with a first halogenating/titanating agent to form reaction product B;

iii) contacting reaction product B with a second stronger halogenating/titanating agent to form reaction product C;

iv) contacting reaction product C with an organoaluminum preactivating agent to form a preactivated catalyst; and

v) heating the preactivated catalyst at a temperature in the range of about 90°C to about 150°C, for a time in the range of about thirty minutes to about a twenty-four hours.

2. The polymer of claim 1 wherein the monomers are ethylene monomers, and wherein the polymer is polyethylene.

3. The polymer of claim 2 wherein the polyethylene has a molecular weight distribution of greater than about 4.0.

4. The polymer of claim 1 wherein the polymerization is in bulk, slurry or gas phase.

5. The polymer of claim 1 wherein the soluble magnesium dialkoxide compound is a reaction product of a reaction comprising an alkyl magnesium compound of the general formula MgRR', wherein R and R' are alkyl groups of 1-10 carbon atoms and may be the same or different, and an alcohol of the general formula R"OH wherein the alcohol is linear or branched and wherein R" is an alkyl group of 4-20 carbon atoms.

6. The polymer of claim 1 wherein the soluble magnesium compound is a magnesium di(2-ethylhexoxide), wherein the alkyl magnesium compound is selected from the group consisting of diethyl magnesium, dipropyl magnesium, dibutyl magnesium and butylethylmagnesium, and wherein. the alcohol is selected from the group consisting of ethanol, propanol, isopropanol, butanol, isobutanol and 2-ethylhexanol.

7. The polymer of claim 2 wherein the reaction further comprises an aluminum alkyl, and wherein the ratio of alkyl aluminum to magnesium is 0.001:1 to 1:1.

8. The polymer of claim 2 wherein any one of steps i)-v) further comprises an electron donor, and wherein the ratio of electron donor to magnesium is in the range of about 0:1 to about 10:1.

9. The polymer of claim 8 wherein the electron donor is an ether.

10. The polymer of claim 1 wherein the halogenating agent is of the general formula $ClQR'''_x$, wherein Q is a nonreducing oxyphilic group, R'''_x is a hydrocarbyl moiety having from about 2 to 6 carbon atoms, and x is the valence of Q minus 1.

11. The polymer of claim 1 wherein the first mild chlorinating/titanating agent is a blend of $TiCl_4$ and $Ti(OBu)_4$ in a range from 0.5:1 to 6:1 $TiCl_4/TiOBu)_4$.

12. The polymer of claim 1 wherein the second stronger chlorinating/titanating agent is titanium tetrachloride, and wherein the range of titanium to magnesium is 0:1 to 2:1.

13. The polymer of claim 1 wherein the organoaluminum preactivating agent is an aluminum alkyl of the formula $AlR^{\wedge}_3$ where $R^{\wedge}$ is an alkyl having 1-8 carbon atoms or a halide, $R^{\wedge}$ being the same or different and at least one $R^{\wedge}$ is an alkyl and wherein the ratio of Al to titanium is in the range from 0.1:1 to 2:1.

14. A process for α-olefin polymerization, comprising:

a) contacting one or more α-olefin monomers together in the presence of a catalyst under polymerization conditions,

wherein the catalyst was produced by:

i) contacting a soluble magnesium dialkoxide compound of the general formula $Mg(OR'')_2$ with a halogenating agent capable of exchanging one halogen for one alkoxide to form a reaction product A, where R" is a hydrocarbyl or substituted hydrocarbyl having from 1 to 20 carbon atoms;

ii) contacting reaction product A with a first halogenating/titanating agent to form reaction product B;

iii) contacting reaction product B with a second stronger halogenating/titanating agent to form reaction product C;

iv) contacting reaction product C with an organoaluminum preactivating agent to form a preactivated catalyst; and

v) heating the preactivated catalyst at a temperature in the range of about

90°C to about 150°C, for a time in the range of about thirty minutes to about twenty-four hours.

15. The process of claim 14 further comprising:

b) extracting polyolefin polymer.

16. The process of claim 14 wherein the monomers are ethylene monomers and the polymer is polyethylene.

17. The process of claim 16 wherein the polyethylene has a molecular weight distribution of at least about 4.0.

18. The process of claim 14 wherein the polymerization is in bulk, slurry or gas phase.

19. The process of claim 14 wherein the halogenating agent is of the general formula $ClQR'''_x$, wherein Q is a nonreducing oxyphilic group, and R'''_x is a hydrocarbyl moiety having from about 2 to 6 carbon atoms.

20. The process of claim 19 wherein the halogenating agent is $ClTi(OiPr)_3$.

21. The process of claim 14 wherein the first halogenating/titanating agent is a blend of two tetre-substituted titanium compounds having the general formula $TiCl_4/Ti(OR'''')_4$, wherein R''''_4 is a hydrocarbyl moiety having 2 to 6 carbon atoms.

22. The process of claim 21 wherein the first halogenating/titanating agent is a blend of $TiCl_4/Ti(OBu)_4$, and wherein the ratio of $TiCl_4$ to $Ti(OBu)_4$ is in the range of about 0.5:1 to about 6:1.

23. The process of claim 22 wherein the ratio of titanium to magnesium present in step (ii) is between about 0.5 and about 5.0.

24. The process of claim 14 wherein the second stronger halogenating/titanating agent is $TiCl_4$.

25. The process of claim 24 wherein $TiCl_4$ is present in the range of about 0.1 to about 5.0 equivalents.

26. The process of claim 14 wherein the organoaluminum preactivating agent is TEAl.

27. The process of claim 14 wherein an electron donor is present in any one of steps i-iv, and wherein the ratio of electron donor to metal is in the range of about 0:1 to about 10:1.